

Visualizing Industrial Dynamics via Stock Market

Visualizing Industrial Dynamics Through Represented Stock
Capital Changes Over about the Past Decade.

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Content

4 | Project Proposal

1.1	Basic info	4
1.2	Background & Motivation	4
1.3	Project Objectives	4
1.4	Data	5
1.4.1	GICS Industrial Sector and Industry	5
1.4.2	Stock Code with Tag	6
1.4.3	Stock meta-data	6
1.5	Data Processing	6
1.6	Visualization Design	7
1.6.1	Overview	7
1.6.2	Specific design on main windows	7
1.7	Must-Have Features	10
1.8	Option Features	11
1.9	Project Schedule	11

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Project Proposal

1.1 Basic info

1. **Project title:** Visualize Dynamics of Stock Market
2. **Group members:**
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3. **Repo:** <https://github.com/dataviscourse2024/group-project-market-dynamic-visualization>.

1.2 Background & Motivation

Analyzing the industrial structure offers an effective perspective for investment analysis. Over time spans ranging from several decades to a century, countless emerging industries have been born and have flourished, while older, less competitive industries have been phased out or downgraded. Observing and analyzing these trends provides valuable insights, allowing for predictions of economic cycles and offering macroeconomic investment guidance.

Industries are always evolving, driven by technological advances, consumer behavior, and regulations. New industries, like digital technology, renewable energy, and biotechnology, have created significant growth opportunities by challenging older business models and reshaping markets on the most recent decades. These sectors can offer high returns to investors who recognize and invest in them early. On the other hand, older industries that fail to adapt may decline, as seen with traditional manufacturing in many developed countries. Understanding which industries are likely to struggle can help investors adjust their portfolios to avoid potential losses.

By systematically monitoring these industrial shifts, investors can develop a more nuanced understanding of economic cycles. They can identify emerging opportunities and potential risks, and allocate their capital more efficiently. Such analysis is essential for formulating long-term investment strategies that align with evolving economic realities.

1.3 Project Objectives

In this project, we aim to provide an effective method for visualizing the dynamics of industrial structures. The major questions we want to answer is:

1. What are the general patterns of the market (economic cycle patterns)?
2. Do industries developments reflect economic cycle patterns (cyclical/counter-cyclical industry)?
3. Are industries growth balanced over a limited period?

4. Are there significant events that have had observable impacts on certain industries?

We believe these four questions are crucial for understanding how industries perform relative to the overall economic cycle at a limit time-span and for making informed investment decisions.

Considerations for Project Execution and Progress:

Note. Rather than creating our own classification standards, we will use the **Global Industry Classification Standard (GICS)**, which is widely adopted in the industry[1, 2]. There are numerous economic indicators that can reflect changes in industries, but we want to keep our approach straightforward and focused. Given that **stock market capitalization** is a direct indicator of industrial trends, preferences, and the development of companies and industries, we will use the **market capitalizations of a few representative stocks within each sector** as our key metric. This will allow us to visualize how their market values have changed over a certain period.

Since this is a short-term project designed for a single semester, we will limit the time frame of the data we visualize to **the most recent 5-10 years**, essentially covering up to a decade. This time frame will provide us with a manageable yet meaningful period for observing significant trends and shifts within various industries.

By focusing on a concise time span and using a clear, widely recognized standard like GICS, we believe our visualization will offer a practical tool for understanding industry dynamics without overwhelming complexity.

1.4 Data

1.4.1 GICS Industrial Sector and Industry

The Global Industry Classification Standard (GICS) is a widely recognized system for categorizing companies into specific sectors and industries, developed by MSCI and S&P Global in 1999, providing a consistent framework for analyzing companies worldwide, allowing investors and analysts to compare performance and trends across various sectors and industries. It divides the global market into 11 sectors, 24 industry groups, 69 industries, and 158 sub-industries, covering the full spectrum of economic activities.

For this project, we will use GICS to classify companies and industries with sector and industry tag. To be specific, we will select the stock based on this classification. The stock will be clustered respected to such tag. A group of stock within the same industrial tag will be grouped up to reflect the development of such industry. We will use 2-level of the classification information, which means specify to GICS industry group (omitting industries-level and sub-industries-level). Such classification information can be found at [GICS white paper book](#).



Figure 1.1: GICS Overview.

1.4.2 Stock Code with Tag

On the next stage, we will obtain the stock code list based on GICS Industrial sector and industry, which means we will select a group of represented stock with stock code based on GICS classification. Fortunately, we found a public data based on S&P 500 (2022), which collects totally 512 stock with {Ticker Exchange, GICS Sector, GICS Industry Group, GICS Industry, GICS Sub-Industry} as meta-data. This data can be found at [Here](#).

Ticker	Exchange	GICS Sector	GICS Industry Group	GICS Industry	GICS Sub-Industry
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Figure 1.2: Attribute: stock code based on GICS.

1.4.3 Stock meta-data

Finally, with the tagged stock code list, we will query a public database to obtain the meta-data of each single stock. The meta-data we queried for each stock will contain closing price, market capitalization, trading volume, etc, combined with its stock code and GICS tag.

The public open source stock meta-data database we are going to query is: [AKShare](#). We will use 5-10 years (end for 2024.8) with week-level interval data. This meta-data has to be query within Python. On the next section we will show the data processing strategy to format our data.

1.5 Data Processing

We will collect and manipulate our data to form a final format. Each entry of the data will have these attributes:

1. Time (quantity): date of the stock
2. Stock code (category): the code of the represented stock
3. Closing price (quantity): the closing price of the stock
4. Market capitalization (quantity): the market capitalization of the stock
5. Trading volume (quantity): the trade volume of the stock

6. GICS sector tag (category): one of the 11 GICS sector tag
7. GICS industry tag (category): one of the 25 GICS industry tag

1.6 Visualization Design

1.6.1 Overview

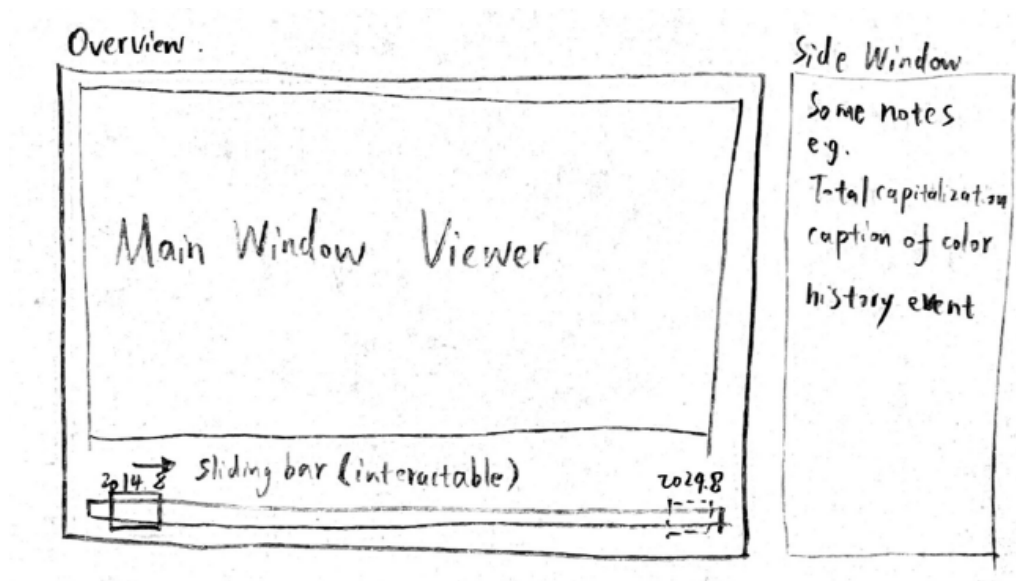


Figure 1.3: Overview of the visualization.

Figure 1.3 provides an overview of our visualization interface. The main interface consists of a side panel for displaying notes, an interactive sliding bar (timeline), and a central viewer for visualization. As the user adjusts the timeline slider, the content in the main viewer dynamically updates to reflect the selected time frame. The side panel presents relevant text, such as important historical events and other contextual information.

1.6.2 Specific design on main windows

The main window will display stock prices corresponding to each GICS sector or industry to illustrate the evolution of a given industry. It will present both the performance of individual stocks and the total market capitalization of the entire industry. To achieve this, we have developed three potential solutions:

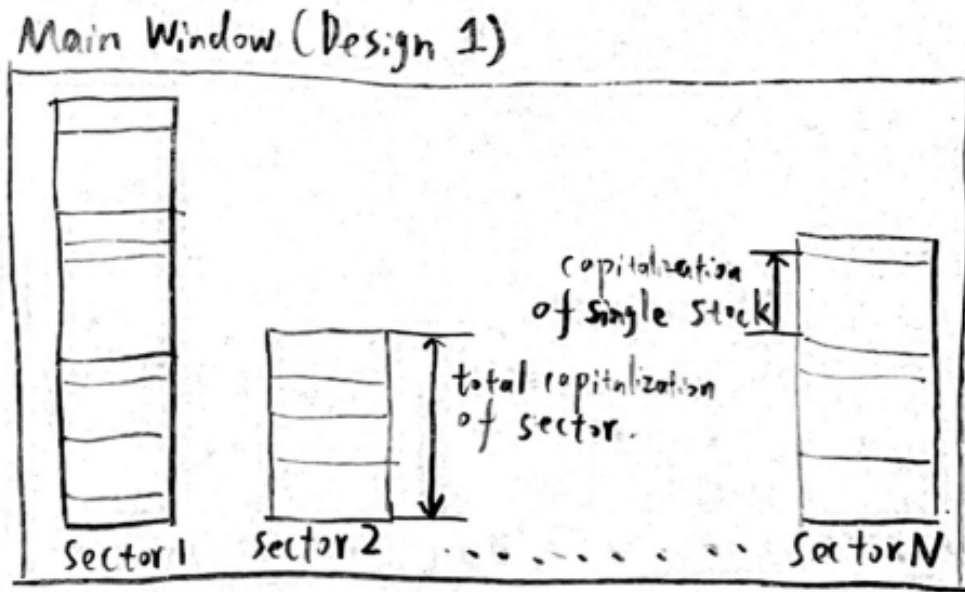


Figure 1.4: Design 1: Using stacked bar diagram.

The first idea we considered was using a traditional stacked bar chart (Fig. 1.4) to visualize the data. However, this approach was discarded for two main reasons. First, if a single industry grows rapidly, the axis may change significantly, leading to an axis-compression problem, where a large maximum scale can obscure smaller values. Second, each industry or sector may include stocks of varying sizes, which can create issues when stacking them on a unified scale. Despite these drawbacks, this design does effectively display both the total market capitalization and the values of individual stocks.

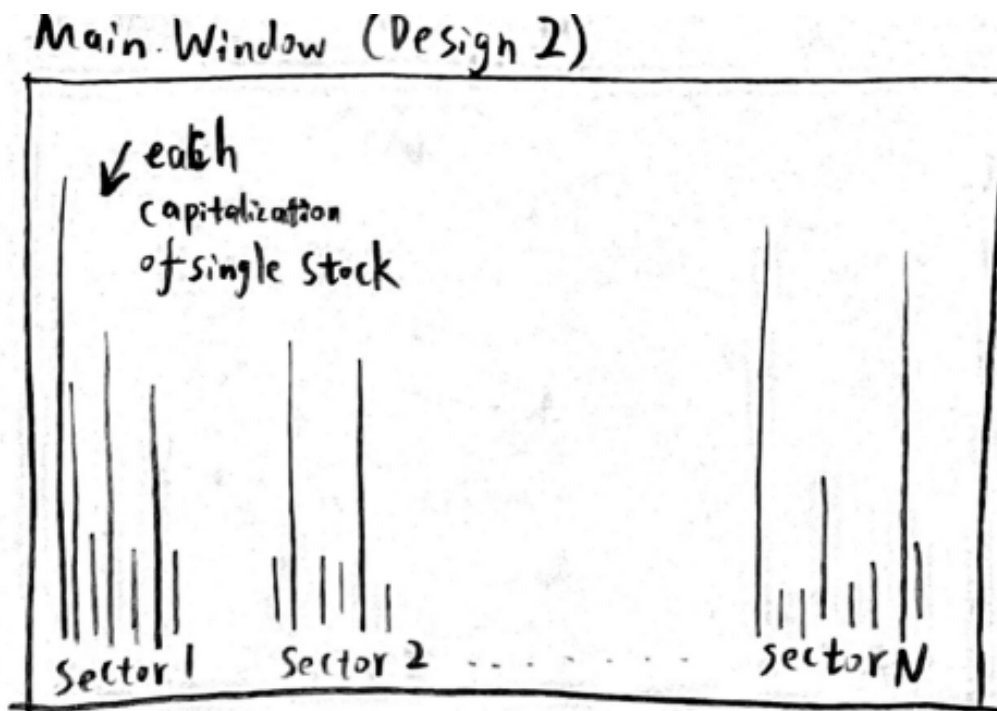


Figure 1.5: Design 2: Using separated bar diagram.

Another idea is to visualize the data using separate bar charts arranged horizontally (Fig. 1.5), with each chart representing the price of an individual stock. While this design effectively highlights the specific value of each stock, it struggles to convey the total market capitalization of each sector or industry. The total capitalization is represented by the combined area of all the horizontal bars. However, this design gave us the insight that using area as a key factor can effectively illustrate relative quantities in a visually intuitive and compelling way.

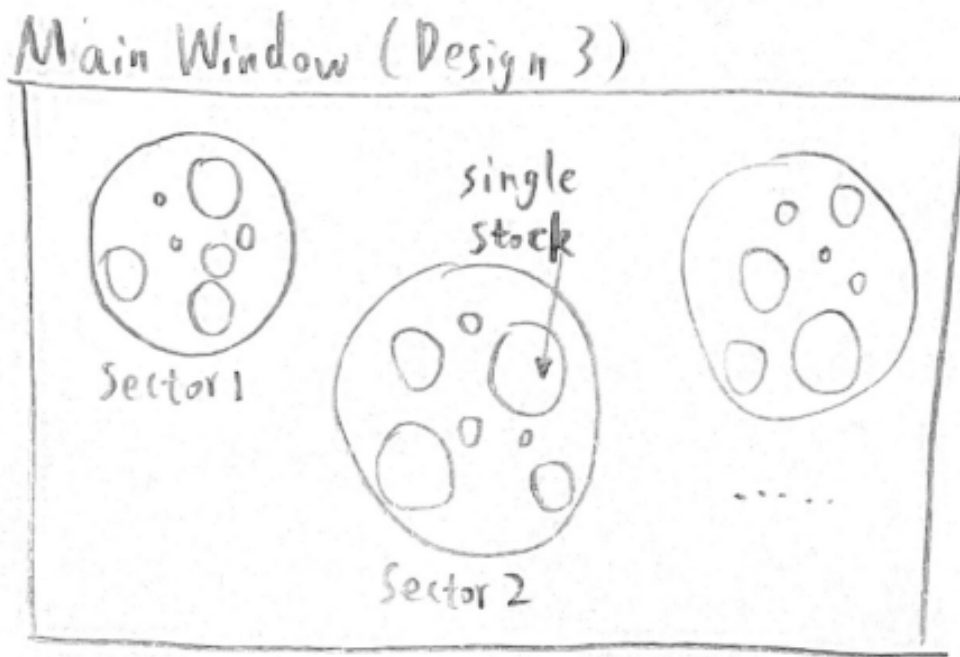


Figure 1.6: Design final: Using bubble diagram.

The final design involves using a clustered circle visualization to represent each sector's or industry's total capitalization, with smaller circles within each cluster representing individual stock prices (see Fig. 1.6). We believe this design offers two main advantages: First, it efficiently displays the relative value of each sector, as sectors or industries are naturally grouped together. Second, it clearly distinguishes each individual stock within the cluster. Additionally, by using circles to represent data, we eliminate the issue associated with using a vertical axis with a unified scale. Smaller stocks appear as points on the display, while more developed stocks are represented by larger circles. This dynamic representation is also intuitive as the user adjusts the timeline(see Fig. 1.7).

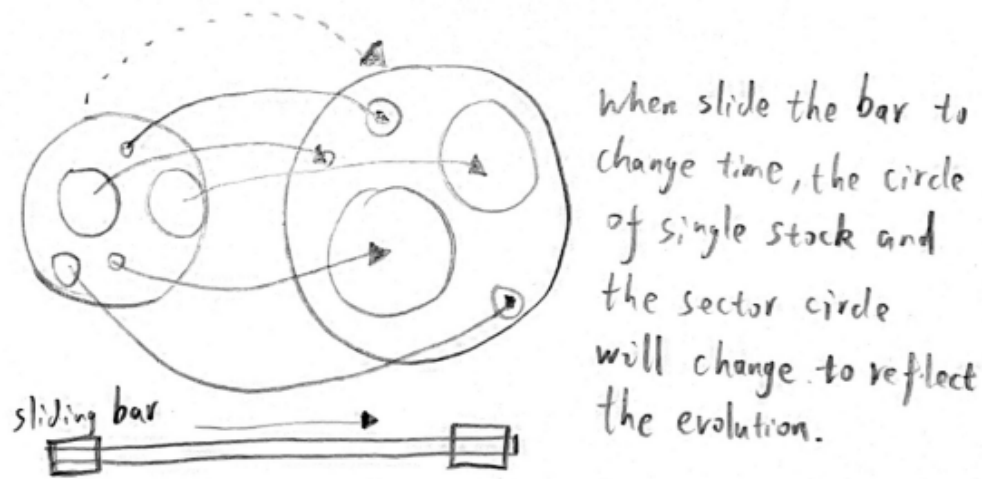


Figure 1.7: Dynamics of bubble diagram when sliding the time bar.

We also provided an stretch up of our optional feature (see Fig. 1.8): as the time bar is adjusted, a separate window will display the total capitalization value of each sector or industry using a line chart.

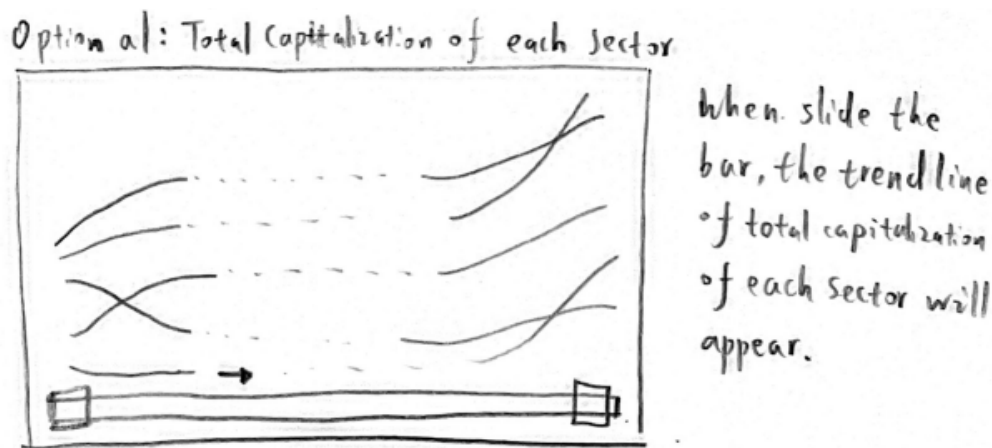


Figure 1.8: Optional feature: display the total capitalization.

1.7 Must-Have Features

Here we list some of the must have features:

1. On the bottom of the visualization windows, there should be a sliding timeline, which allow users to interact with the windows to show different time period of the market.
2. The main window can display clustered data, each cluster are based on GICS sector/industry classifications.
3. On each cluster, there should be a set of circles to represent single stock. The diameter of the circles should reflect the price of such stock.

1.8 Option Features

Here we list some optional features.

1. Another separate window displays the total market capitalization of each sector and industry (summation of single stock's capitalization within it), reflecting the overall economic development situation.
2. Another separate window displays the percentage of each sector or industry relative to the total market capitalization (summation of all).

1.9 Project Schedule

Our schedule:

1. Week 5-6: Finish the data collection and data processing.
2. Week 7-8: Add a sliding timeline, which allow the user to interact with. Main window can reflect the action of such time.
3. Week 9: Adding circles to display the stock data.
4. Week 10: Finalize the project to make it beautiful.

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Bibliography

- [1] MSCI Inc. and S&P Global. Global Industry Classification Standard (GICS®), 1999.
- [2] State Street Global Advisors. GICS Sector and Industry Map, 2024.
- [3] MSCI Inc. Global Industry Classification Standard (GICS®), 2024.